

Changing the nature of lectures using a personal response system

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This article describes the use of an Electronic Voting System (EVS) in large group lectures within a business and management undergraduate degree programme, in an attempt to make them more interactive. The intention was to ensure that the introduction of the EVS-style lecture was educationally driven, linked to interactive learning activities in the lecture, and reflected a clearly articulated understanding of the kind of learning that was appropriate for these students. Findings are presented and discussed in terms of the impact on students' learning and on the role of the lecturer. Our conclusions show that the students' experience of the EVS interactive lectures fell into three distinct stages and that students fall into one of three types, based on their general relationship to EVS-based lectures. In addition, EVS-style lectures impacted significantly on the role of lecturers. Finally, the findings demonstrate that interactive lectures that are supported by technology, but that are driven by educational ends, can enhance students' learning.

Keywords: Electronic Voting Systems; interactive lectures; constructivism, social constructivism

Introduction

Kingston University is a large multiple-campus higher education institution to the south-west of London in the UK. It provides undergraduate and post-graduate programmes in a wide range of academic disciplines, including undergraduate degrees in business and marketing. A large number of students (500) undertake certain Year 1 modules within both the business and marketing degrees at the same time. The teaching for these modules has traditionally been delivered through lectures.

Like many universities, ours had steadily recruited higher numbers of undergraduates, partly as a result of government policy and the development of an era of mass higher education (Scott, 1995). This has thrown up newer debates such as rethinking university teaching (Laurillard, 1993), and the need to provide more flexible learning methodologies (Laurillard & Margetson, 1997). A decision was taken to change from a traditional lecture to an interactive lecture approach using an Electronic Voting System (EVS) in two first-year modules that were being undertaken by the same large group of students.

In this article we use the learning and teaching framework by Renshaw (1995) against which new technologies such as EVS can be implemented and evaluated. The implementation of EVS within interactive lectures is then presented, followed by the

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evaluative research project that was undertaken to examine the impact of this new approach on both students and lecturers. The findings indicate that the interactive lectures using EVS had a positive impact on students' learning, as well as a significant impact on the role of the lecturer.

Background

Renshaw (1995) attempted to explore what was to count as excellence in teaching and learning, suggesting that there was little or no consensus. On the one hand, for example, is a traditional notion where excellence is framed by a model where lecturers directly transmit knowledge and/or skill, e.g. through a traditional lecture (the transmission paradigm). At the opposing pole, is a view that excellence in teaching and learning occurs when lecturers' activities are geared *primarily* to enable and support students' construction of personal meaning and understanding (the constructivist paradigm).

In offering a framework for moving beyond this dichotomy of paradigms, Renshaw presents a fourfold approach to understanding learning and teaching, providing a mechanism for identifying key teaching and learning tasks for the lecturer and students within each of these four paradigms (See Figure 1). The aim of using such a fourfold framework is for lecturers firstly, to clarify the overall intention/aim/purpose of their teaching and, secondly, to use the framework to help make decisions about the approaches to teaching they wish to use and ways of assessing the quality of their teaching.

The transmission model is commensurate with an understanding of teaching as telling, explaining, or demonstrating. It is reflected in the design of many lecture halls, with seats in rows facing the lecturer, who is 'the sage on the stage' (Duraghee, 1998). Renshaw (1995) argues that this transmission model promotes a surface approach to learning rather than the deep understanding desired by the lecturer.

At the other end of the spectrum is the constructivist model. Within this paradigm (see Figure 1), lecturers demonstrate excellence when they engage students in a range of activities that encourage them to construct new understanding and insights, and to develop a deep approach to learning. Within this model, learning activities are provided to enable students to test their own ideas against those of other students. The lecturer creates the conditions that are conducive to this way of working. Rather than being a 'sage on the stage' the lecturer's key task is to act as a 'guide on the side' (Duraghee, 1998).

The two additional paradigms proposed by Renshaw (1995) are both based on the premise that knowledge is socially constructed, and is therefore progressively subject to change. One is the *metacognitive model* (See Figure 1). Within this paradigm, the lecturer supplements curriculum content with activities in the classroom that are designed to model specific cognitive processes to enable students to develop expertise in these cognitive processes. Approaches such as cognitive apprenticeship (Collins, Brown, & Holum, 1991; Berryman, 1991) and critical reflection (Brookfield, 1995) are employed. The role of the lecturer is to provide activities that require students to be reflective and aware of the thinking skills and processes required of expert practice in the discipline being studied.

The other model is the *socio-cultural* or *social constructivist* model. Based on work by Vygotsky (1978), this model sees the student as being in the process of entering the practices, values, and ways of thinking and speaking of the wider community,

The Transmission Model		The Constructivist Model	
Learning is: <ul style="list-style-type: none"> • Performing a task • Cumulative • Receptive • From the outside in • Practising/performing 	Teaching is: <ul style="list-style-type: none"> • Giving information correctly • Sequential • Direct • Structuring the environment • Rewarding performance 	Learning is: <ul style="list-style-type: none"> • Personal understanding • Interpretative/selective • Active • Constructive • Reviewing/integrating 	Teaching is: <ul style="list-style-type: none"> • Setting challenging tasks • Observing/ interviewing • Supporting learner activity • Creating dissonance • Helping learners to reconsider
Metacognitive Model		Socio-Cultural Model	
Learning is: <ul style="list-style-type: none"> • Mindful engagement • Managing learning tasks strategically • Reflecting and monitoring • Adapting and transferring • Self-evaluating 	Teaching is: <ul style="list-style-type: none"> • Explaining meaning/experience • Modelling learning strategies • Supporting reflection • Helping to apply across contexts • Providing evaluation criteria 	Learning is: <ul style="list-style-type: none"> • Social • Assisted performance • Interactive and co-constructive • Self-regulating group membership • Evaluating with shared values 	Teaching is: <ul style="list-style-type: none"> • Joint activity • Scaffolding participation • Guiding the conversation • Assisting in joint construction of meaning • Demonstrating community/professional values

Figure 1. Contrasting approaches to learning and teaching (adapted from Renshaw, 1995).

e.g. the practice world of the particular field (e.g. business, marketing, management, medicine, engineering, and so forth). Central to teaching and learning in this paradigm is social participation with others, facilitated by the lecturer, where students are guided to adopting the language, practices, forms of representation, and attitudes of a particular knowledge community. Within the metacognitive and social constructivist paradigms, the role of the lecturer is likely to reflect that of ‘meddler in the middle’ (McWilliam, 2008).

With these diverse paradigms of teaching and learning, the remainder of this article will present the introduction of a major change in the delivery of lectures in business and marketing to large groups of students, mapped against the above paradigms of learning and teaching. An evaluative research project was undertaken to measure the effect of this new approach to lectures on students’ learning and on lecturers’ roles.

Using an Electronic Voting System

From our own experiences, and from our observations and module and programme evaluation over a period of time, we began to realise that our traditional lectures were less than satisfactory. Firstly, students’ attendance in these lectures dropped quite significantly after the seventh lecture out of a sequence of 26. Secondly, some students were disruptive in the large-group lectures, similar to the problem identified by Boyle and Nicol (2003), sometimes requiring the lecturer to intervene. Thirdly, feedback from the students showed that a 50-minute lecture exceeded their concentration span. They also reported a degree of social isolation, feeling ‘...lost in the large lecture hall’ (student’s comment).

Finally, the mainly didactic nature of our lectures appeared to create passivity in students and may have been a cause of the disruptive behaviour identified above. In addition, retention rates for our Year 1 students needed to be improved and we wondered if the traditional lectures were a factor affecting attrition in this first year.

We began discussing the use of Electronic Voting Systems (EVS) within an interactive lecture format. Freeman (1997), Wit (2003), Boyle and Nicol (2003), and Draper and Brown (2004) all demonstrated the benefits of using EVS in an interactive lecture.

The literature related to reasons for adopting the EVS into interactive lectures included its emphasis on developing cognitive skills (Wit, 2003; Elliot, 2001). In addition, research into the use of EVS systems shows that it improves learners' attention and learning scores (Hake, 1996; Abrahamson, 1999). Furthermore, there is growing evidence that the introduction of EVS-style interactive lectures facilitates and encourages interaction amongst members attending a class (Sarah, 2002; d'Inverno et al., 2003) and promotes constructivist learning (Liu, Wang, & Chan, 2003). Elliot (2001) found that using EVS had a significant effect on students' performance in lectures, stimulating their interest and concentration, and encouraging active learning. Boyle and Nicol (2003) found that the unique contribution of using EVS in large-group classes was the quality of feedback (to students) that it enabled.

We explored a number of systems that we might use and ultimately selected one called the Personal Response System (PRS). Today, many commercial companies offer their own version of electronic voting systems, of which PRS is just one. There are major market users of EVS, including the private and public sectors whose use ranges from consultation and voting (local communities), training and development, marketing, market research, and team project management. The best known example comes from the media industry where EVS is a feature of television programmes – including 'Who Wants to be a Millionaire'. EVS could be applied in any area where a voting or decision-making process is involved.

EVS involves supplying students, either individually or in small groups, with an electronic handset. Using the handset, students answer questions or complete learning tasks after they have discussed the question/task in their small groups. The answers are then transmitted to a computer and the results of all the student responses to the question are displayed in the form of a histogram on a screen at the front of the lecture hall. The histogram provides students and lecturers with a visual representation of the different answers to the questions given by the student groups. The results are discussed between the lecturer and the students, and individual students/groups can see how their answer compared to those of other students and to the correct answer provided by the lecturer. Stuart, Brown, and Draper (2004) suggest that the lecturer can obtain immediate feedback about what the students think they understand and, subsequently, lecturers can redirect their teaching to address where real weaknesses lie.

The education sector is becoming a major user of EVS, particularly in higher education, with uptake taking place in physics (Abrahamson, 1999; Hake, 1996), economics (Elliot, 2001), chemistry, mathematics, statistics and computing (Wit, 2003; D'Inverno, Davis, & White, 2003), social sciences (Sherman, 1995), logic (Stuart et al., 2004), and business and management areas (Alavi Bradley, Wheeler, & Valacich, 1995; Atwong & Hustad, 1997).

We decided to provide new, interactive lectures for Year 1 undergraduates in marketing and business. We wanted to create a stimulating learning environment that would engage students by making them proactive rather than passive learners. We felt that this approach would enhance students' learning on our business modules. We also believed that incorporating EVS into an interactive lecture, together with small peer group problem-solving activities during the lecture would help to build up students' own self-confidence, and would stimulate interaction between learners, and with lecturers that led to a shared process of knowledge-building.

Because we believe that educational ends precede technological means, we saw a number of potential pedagogic benefits of using EVS in interactive lectures, including better pacing of materials through presenting material in shorter packages of learning or 'chunks' (Gobert et al., 2001). We were also attracted to the potential of the EVS and interactive lectures to foster activity on the part of students. It seemed to us that the interactive lectures we were proposing would provide for collaborative and social learning through small group work problem-solving activities in the lecture, and could promote the development of cognitive processes. In addition, the interactive lectures using our chosen EVS system would encourage students to work together to co-construct meaning from the material being presented in the lecture. In short, we wished to move from a transmission model to one which reflected a blend of constructivist, metacognitive and social-constructivist approaches to learning (see Figure 1).

Our new interactive lectures using the PRS system would still take place in the conventional lecture hall. However, our intention was to change our lectures so that packages of information were first presented. These were followed by problem-solving tasks being carried out by the students working in small groups related to that 'chunk' of information. This is quite possible to achieve even in a conventional lecture hall with fixed seating. Through group discussion and decision-making the group had to select from a list of answers the one which they, as a group, agreed was the best answer to the problem. Using remote handsets, each group records its answer to the problem. These are instantly displayed on the lecture-hall's screen (in the form of a histogram). An example of one histogram can be found in Figure 2.

The lecturer uses this data to confirm the correct answer and explain and discuss the rationale for the answer.

The evaluative study

An evaluative research project was undertaken to answer two research questions:

- (1) What are the students' perceptions of the impact of the interactive lectures using PRS on their learning?
- (2) What is the impact of using PRS-style interactive lectures on the role of the lecturer?

The intention was to gain a deeper understanding of the impact of using interactive PRS-style lectures.

Data from students were collected using questionnaires and focus group interviews. From these, thematic analysis was undertaken. Data from lecturers were

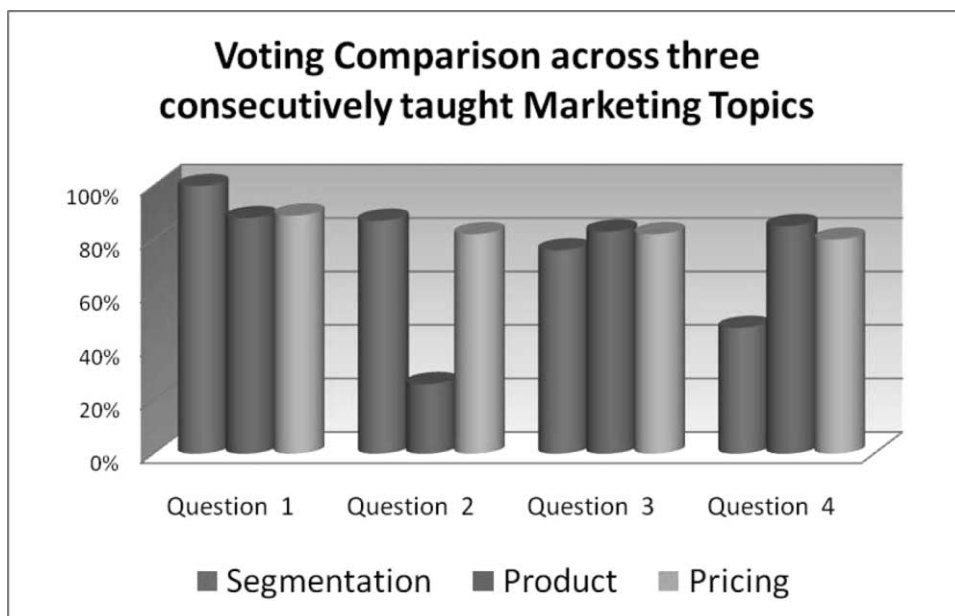


Figure 2. Example of PRS histogram.

Note: This is a comparison of three EVS supported lectures on separate consecutively taught topics with the same group of students.

collected through reflective teaching logs that they completed throughout the period of the study, and from video recordings of a sample of PRS-style lectures. These were also analysed using thematic analysis. Finally, the standard module evaluation forms that are used throughout the university contributed data for this study and were compared with module evaluations from previous cohorts.

Two types of findings emerged: one related to the impact of the interactive lecture using PRS on students' learning and one related to the findings in terms of the changing role of the lecturer.

Impact of interactive lectures on students' perceptions of their learning

Questionnaires were administered to students and data from these were triangulated with analysis of transcripts of focus groups with a sample of students. The response rate for the survey questionnaire was 40% ($n = 165$). Questionnaires were analysed through calculation of mean. Analysis indicated that students perceived the effectiveness of their learning was improved through the PRS-style interactive lectures (mean response rate, 4.25 out of 5). The analysis of the qualitative data identified five recurring themes about the impact of PRS-style interactive lectures on students' learning. These were:

- Students' enjoyment of the PRS-style lectures and how this contributed to their learning (mean response of 4.7 out of 5 for the question on enjoyment).
- Contribution of consultation and active participation to students' learning (This theme was identified as a factor in improving learning, with a mean score of 4.35 out of 5).

- Contribution of reinforcement (feedback) to students' learning (mean score of 4.45 out of 5).
- Contribution of team decision-making amongst students to their learning (mean score was 4.6 out of 5).
- Contribution of interactivity in a lecture to students' learning (mean score was 4.7 out of 5).

Students were able to articulate how the PRS-style interactive lectures positively influenced their own effective learning behaviours using phrases like:

'I feel myself learning more'.

'We can really learn with our group. I do not have to spend ages re-reading my lecture notes in order to get it'.

'...felt I really understood the basics; the concepts of marketing. Before, I was not so sure'.

'...if it (PRS) helps you to know, then learning this way is good'.

Although the introduction of the interactive lecture using PRS was not intended specifically to address or improve assessment marks, quantitative data were collected from assessment board minutes/assessment results and analysed. The results indicated that students' average aggregate performance improved for both modules in 2003/4 after the PRS-style interactive lectures were introduced, compared to the previous cohort of students. The student-profile was similar across the present and previous cohorts, the method of assessment was identical and the same module leaders gave the lectures in both years. The only tangible variable was that in the 2003/4 cohort, the lectures were interactive using PRS. For both modules the average aggregate of students' marks rose from 56% in the 2002/3 first-year cohort to 59% in 2003/4 cohort. While statistical significance was not tested as part of this evaluative study, the upward trend in students' marks is encouraging, and the change to the type of lectures provided is likely, we believe, to have made some contribution to these improved assessment results. A larger longitudinal study would be needed to examine whether this change in lecture format had a significant effect on overall assessment performance.

From analysis of the qualitative data a threefold model of response from students to the use of PRS in interactive lectures emerged. This model shows three stages of response to PRS by students.

Stage 1 – Early mass acceptance

This stage occurred in the early period after the launch of the PRS-style lectures. The majority of students found that their initial experiences of PRS in large-group lectures were very satisfactory and this was attributed to a number of factors, including the newness of the innovation and lecturers' enthusiasm. The majority of students welcomed the change from traditional lectures. Our study did not indicate, however, whether this early mass acceptance was related to their preferred ways of learning. In this stage, students appeared to hold strong attitudes and feelings towards the use of PRS. The novelty factor is evident and this style of lecture, according to students, relieves the monotony of traditional lectures.

Stage 2: Reflection

The reflection stage occurred after students had experienced the interactive lecture for some time. In this stage students started to analyse this way of learning at a deeper level and went beyond their enjoyment of the experience, articulating the difference between traditional and PRS-style lectures in terms of their learning. Students identified that their learning was positively influenced by the interactivity, engagement, group and peer instruction, and rapid feedback to their PRS responses.

They also began to assess the strengths and weaknesses of both types of lecture in a more analytic fashion. Although the PRS lectures were still perceived as being enjoyable, in this reflection stage, some students begin to express reservations about this type of lecture such as distractions when other students do not take the group discussion time seriously. If Stage 1 was defined by students' enjoyment for this new approach to lectures, Stage 2 demonstrated a more mature and reflective way of thinking in relation to PRS as a process for learning. During Stage 2 students appeared to fall into clusters according to their ideas, feelings, perceptions and attitudes towards PRS. These can be categorised as:

- Type 1: Students who feel they 'must have it'.
- Type 2: Students who perceived that they 'need it, but with minor reservations'.
- Type 3: Students who are 'sceptical, but believe that it needs to improve'.

Type 1 students plainly just liked this way of learning – as reflected in the following comments:

'It's a great way of covering the material'.

'Information is well-explained'.

'The environment is great...one where you are interacting'.

'It was completely different from the way you assumed the lecture was going to be like.

There was a group vibe; everyone conferred and you got to be in your group. There was a question in front of you and everyone had a discussion'.

'We had immediate feedback from the PRS...I knew what I needed to do more work on...'

Their responses demonstrate that they value being active learners in the lecture. Types 2 and 3 students are discussed in the next stage.

Stage 3: 'Divergence'

Stage 3 is where students began to become more sophisticated about PRS and its potential. Those students who fell into Types 2 and 3 in the previous stage appeared to engage in constructive reflection about the potential for, as well as the reservations about, PRS. Some students who had very fixed ideas about traditional lectures, especially those who came from educational systems where there was an extremely strong belief in the 'professor-model' found it more difficult to accept PRS in a large-group interactive lecture. This may have implications for how interactive lectures using PRS may be of particular importance in a widening-access system of mass higher education.

The sceptics (Type 3) are so characterised because they also present constructive ways of overcoming any perceived defects in this approach to learning, or they redefine new roles and applications for PRS as an interactive tool. Type 2 students appeared to be protective towards the PRS ideology. However, the findings suggest that Type 3

students appeared to take marketing and customer orientation concepts (these students were marketing students) and applied them by suggesting new uses for PRS in order to meet other needs. In other words, these students were suggesting product improvement to the existing use of PRS and offering suggestions as to how feedback and interaction in the PRS-lecture could be expanded.

Finally, a weakness in the study was that it did not offer us a robust way of determining whether the primary value of the PRS-style lectures to the students' learning came from the small-group interactivity, or whether it was the result of the PRS technology. What emerged from the data was that for some students it was the interactivity that was of primary value, for others it was the PRS technology (especially with regard to communicating the group's decision and receiving immediate feedback), while for other students the two could not be separated and were part of a greater whole.

Impact of PRS on lecturers and their roles

As well as the findings related to the impact of PRS on students' learning, our study identified a second stream of findings that was related to the roles of lecturers. Data were collected from lecturers' logs and were triangulated against video recordings of a sample of interactive PRS-style lectures and additional data from students about their perceptions of lecturers' roles. The lecturers who participated in the change to interactive lectures using PRS appeared to have developed a new understanding of how students learn. They recorded that they can:

'better appreciate and articulate the contribution of the different paradigms of learning...'
(participating lecturer)

These lecturers had a new understanding and appreciation of constructivist, metacognitive and social constructivist paradigms and their impact on student's learning. As a result of this project, the pedagogic perspective of the lecturers has changed from one that was teacher-centred to one that is student-centred.

The complexity of lecturing roles became clearer the longer we used PRS in our lectures. Indeed, the benefits arising from PRS were better understood when seen through the variety of roles that lecturers play. Our data suggest that any innovator seeks to enjoy benefits from changing to this way of lecturing, but these must be understood in terms of the other roles that are active in the same context.

Through the thematic analysis of the data from lecturers, five roles for lecturers in higher education have emerged, and each one is likely to have a powerful relationship to the use and benefits of PRS. Analysis of data from lecturers' logs revealed that it is important to acknowledge these roles, both independently and interdependently, because they contribute to a clearer understanding of what happens when lecturers attempt to innovate.

The pedagogic role

The pedagogic role is where many lecturers seek continuously to explore new ways of exercising their craft, quite separately from their subject expertise. This role is likely to increase in priority for a number of reasons, e.g., academic subject benchmarking, institutional impetus to raise the standards of teaching, increasing availability of ICT

applications (of which PRS is an example), module evaluations by students, and links between pedagogic performance and staff appraisal.

The professional role

The professional role encompasses a wide set of factors each related to the different cultures that exist within different subject disciplines (Becher and Trowler, 2002). Different academic disciplines are likely to exercise differing norms of professional practice, whether this is related to knowledge acquisition (research) or the knowledge transmission process (pedagogy). There is a tension between research activities that enhances the professional role compared to the perceived lower standing of researching the pedagogic role. There is little recent evidence about the priority given by lecturers to researching learning and teaching. Indeed, historically, many lecturers gave low priority to undertaking research into learning and teaching with high priority given to undertaking research that results in publications related to the subject discipline. This would suggest, however, that part of the professional role, regardless of subject discipline, requires a more scholarly understanding of how students learn and its implication for teaching. Through involvement in the implementation of the PRS-style interactive lectures, the lecturers have embraced this aspect of the professional role.

The personal role

The personal role is about a lecturer's personal motivation, attitude, values and beliefs. An individual lecturer's behaviour continues to be the outcome of personal motivations, attitudes, perceptions, values and beliefs. Prior to implementing the PRS-style lecture we undertook an analysis of both the drivers and risks related to this change. The way in which academic staff perceive the level of risk in an innovation may affect decisions to engage in educational innovations. From the lecturers' experiences, the main benefit of this particular innovation was personal enjoyment from the 'buzz' of interactive learning that was experienced in this new type of lecture.

Facilitator of students' effectiveness

Facilitator of students' effectiveness emerges from the data as a newly-identified role as a lecturer. From the students' module evaluations for one module (Marketing) when we introduced the new PRS-style interactive lectures, the overall rating scores for every category that related to teaching and learning effectiveness increased by at least 5%. For the second module (Business Information Systems) the scores increased by 4.3%. The perceptions of both of the lecturers who engaged in this new interactive approach to lecturing were that the use of PRS contributed positively to the change in their lecturing style.

Innovator

Innovator as a role suggests that lecturers are in tune with pedagogical developments, how they can be assessed as suitable for use within their discipline, and how change management principles and models can be applied to the introduction of new pedagogical approaches.

Based on the data from the lecturers it is possible that a sixth role, that of product champion, may also be emerging. In this role, the lecturers who piloted the PRS help academic colleagues in other discipline areas to consider and adopt PRS-style interactive lectures.

From the analysis of data from lecturers, it appears that the use of PRS in interactive lectures has created an additional tool for teaching students that has transformed the learning ethos from one of students' passivity to activity, giving the lecture room an environment of learning excitement and reducing the well-documented problems inherent in teaching large groups of students. Lecturers also reported heightened enjoyment of teaching and a greater degree of job satisfaction. PRS has positively changed their ideas about lecturing, increased their motivation, created more positive perceptions of learning and teaching, and promoted a greater understanding of learning theories and their application to pedagogic innovation.

Taking PRS forward – what next?

Use of PRS in interactive lectures allowed us to have a better understanding about how students think and how they learn, and gave us a clearer understanding of whether learning is taking place. This information enabled us to gauge what we should do next in a lecture class. We have now begun to explore new ways of presenting interesting and diverse small group learning tasks within the PRS-style lecture such as:

- Using digital clips of video material in Marketing that present one-minute scenarios embedding a problem
- Creating short cases in text form that offer differing perceptual choices; for example, 'will the customer buy now?'
- Making links to websites for one minute access followed by broader questions, e.g., 'From your analysis of this website, in what type of marketing environment are they operating?'

Finally, earlier we indicated that we had identified a number of problems with our traditional lectures. Since implementing the interactive lectures using PRS attendance at lectures is greatly improved, disruptive behaviour in lectures is almost non-existent and students have indicated that they find the lectures motivating and interesting – as reflected in the following comments:

'Lectures have come alive. Before, in most classes, I think most students were not listening. Some people sitting next to you did not want to know'.

'It was completely different from the way you assumed the lecture was going to be like. There was a group vibe; everyone conferred and you got to be in your group. There was a question in front of you and everyone had a discussion'.

Finally, it appears that a major benefit of the new-style lecture was in the introduction of interactive small-group activities rather than in the PRS system. A possible limitation of the study may be the absence of specific questions related to the use of the technology rather than on the students' experience of the whole package of interactivity and technology. However, the way in which the students fell into the three types of response described earlier demonstrates the perceived positive impact of the technology on their learning.

Conclusions

Interactive lectures using PRS has opened up a new dimension for exploring different approaches to learning and teaching that has affected our understanding of effective pedagogy. By using Renshaw's model (1995), we implemented an innovation that had educational ends embedded in a richer blend of learning and teaching models that were assisted by technological means.

Analysis of the data from the students in our evaluative study suggests that when PRS was integrated into these business and marketing lectures, it changed the way they engaged with new material and with each other, by promoting deep and active approaches to learning. Students took part in fruitful dialogue about important curriculum concepts and principles, solving problems, and sharing their thoughts with other students and the lecturers. All of these reflect, at different times and in different ways, a blend between transmission, metacognitive, constructivist and/or social constructivist models for learning and teaching as described by Renshaw (1995).

We gained new insights into how students perceive the interactive PRS-style lecture. Firstly, over time, the students' experiences of the PRS lecture fell into three distinct stages. This now offers us opportunities for future research and suggests that lecturers need to take these stages into consideration when implementing PRS-style interactive lectures. Secondly, we found that students fell into one of three types, based on their general relationship to PRS lectures. Our observations and reflections as lecturers appeared to confirm that students became more receptive learners; their experiences of social alienation in the large lecture diminished as they became active in their small groups, and they appeared to behave in a more empowered way.

Interactive lectures using PRS in large groups appeared to change the lecturers' approach to learning and teaching, and the appreciation of the role of lectures in today's higher education. We became aware of a wider range of educational uses to which EVS could be put at both post-graduate and undergraduate levels as flexible tools embedded in lectures such as for conducting formal multiple-choice tests; as revision tools; as aids for socialisation; for grouping and tracking team performance across a semester; for promoting decision-making skills as a social process; and for generating ideas during a tutorial session. All of these show a shift from learning and teaching in a transmission model to a more complex set of learning and teaching processes.

Lectures need not be outmoded pedagogic practices. Indeed, when re-examined in terms of educational ends and blended with technological means, lectures can be highly interactive and beneficial for effective learning.

Notes on contributors

George Masikunis is a principal lecturer in marketing in the School of Marketing in Kingston University Business School. He has a wide range of teaching experience gained from working in both further education and higher education sectors. He has published papers and presented at numerous conferences, primarily exploring the use of virtual learning environments in teaching and learning for different groups of students. His research has particularly focused on the use of publishers' electronic materials as a supplement to textbooks in marketing programmes and using electronic voting systems in a variety of settings.

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and was a chair of business and an academic dean for the period of 1986 to 1997. Andreas has produced some educational films and has supported, mentored, and developed staff in the use of mobile technologies in classroom in the UK and in Russia, Cyprus, Greece, and India. He has written several articles and conference papers related to the use of electronic technologies in support of learning and teaching.

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